MARKET CHALLANGES & PROSPECTS
CHP IN INDUSTRY, THE INDIAN PERSPECTIVE

Presented by

S. C. Natu, Vice President
MITCON LTD., PUNE, INDIA

at

1ST INTERNATIONAL SYMPOSIUM
COMBINED HEAT & POWER :
ENERGY SOLUTIONS FOR THE 21ST CENTURY
(Washington DC, February 1-2, 2000)

MARKET CHALLANGES & PROSPECTS
CHP IN INDUSTRY, THE INDIAN PERSPECTIVE

CONTENTS

INDIAN ENERGY SCENARIO

Low per capita energy consumption (0.8 tonne of coal equivalent)

Lower energy productivity (US $ 400, GNP/tonne of coal equivalent)

Rising population & economic growth (respectively by 2-3 % & 4-5% per year)

Continued dependence on depleting commercial sources (90,000 MW installed capacity, 70 % coal)

Growth in energy consumption (10-12 % every year)

Demand in excess of supply (additional 60,000 MW capacity required by 2004 / 5)

Low pace of energy efficiency improvement

Insignificant contribution from renewable sources of energy (<2%)

Severe shortage of funds

Delayed initiation of the power sector reforms

15-30 % T & D loss in different States

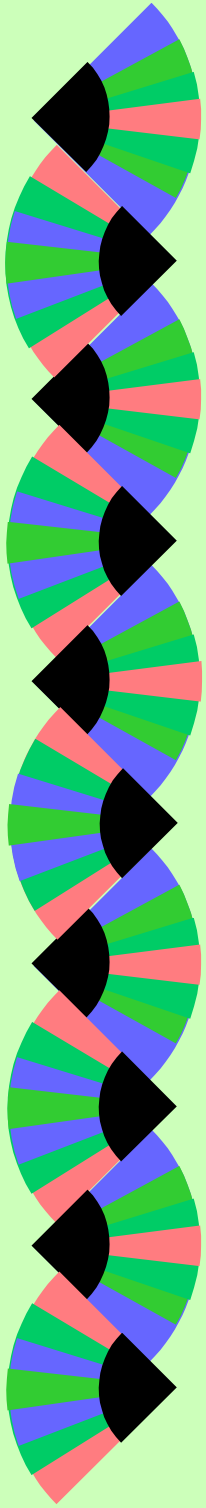
Peak demand shortages of 8-30 %, in different States

Energy availability shortages up to 15 %

Un-realistic pricing of energy

The obvious focus calls for

- Drastic steps for energy efficiency improvement
- Speedy tapping of the renewable sources of energy like bio-mass (including bagasse co-generation), wind and small hydro
- Power from co-generation in other sectors, municipal and industrial solid / liquid waste
- Environment efficiency improvement for sustainable development



CHP, AN EXCELLENT SOLUTION TO INDUSTRIAL USERS

The chronic situation of energy in India offers excellent potential for adding capacity through implementation of CHP projects in Indian Industries, which have tremendous untapped potential of about 20000 MW.

CHP projects are energy efficient technology as they utilise low grade exhaust heat from the steam turbine for process, thereby improving efficiency of energy utilisation of 30% for the conventional power generating systems to 70-90%.

CHP projects are cheaper source of power for industries compared to conventional power purchased from SEBs, thus saving their fuel bills substantially and changing economics of their operation dramatically.

CHP projects have lower capital cost compared to conventional power projects as well as low gestation periods.

CHP projects reduce pollution levels for the industrial units significantly due to comparatively lower consumption of fuel and can very well qualify for CDM / JI projects.

Development incentives offered for implementing CHP projects in industries in India, make them excellent integration option for the industries, with all the above benefits.

Technology, equipment and skills for implementing CHP projects in Indian industries are available.

ECONOMICS OF CHP PROJECTS

The capital cost per MW of installed capacity for CHP projects ranges between Rs. 20-40 million, compared to Rs. 45-60 million for conventional power plants.

The average Debt Service Coverage Ratio (DSCR), IRR & pay-back periods for CHP projects and conventional power plants are compared below; for Indian lending terms :

	CHP Projects	Conventional Power Plants
Average DSCR	2 - 2.25	1.4 - 1.7
IRR (Post tax on equity), %	25 - 50	16 - 20
Pay-back period, year	6 - 7	8 - 9

POTENTIAL FOR CHP IN INDIAN INDUSTRY

Sr. No.	Sub-sectors	Total Potential (MW)	Realisable Potential (MW)
1	Sugar	4000	3000
2	Dairies, Distilleries & Breweries	3500	2500
3	Rice mills	1500	1100
4	Cotton textile & man-made fiber	1200	800
5	Paper & pulp	1000	750
6	Fertilizers	1000	750
7	Chemical (solvent extraction, sulphuric acid, caustic soda)	900	600
8	Petrochemical & refineries	800	600
9	Metal industries (iron & steel, sponge iron & alumina)	750	500
10	Cement, tyre & plywood manufacturer	600	400
11	Other Sectors (coke oven batteries, commercial sectors, etc.)	750	500
	Total	**16000**	**11500**

IMPORTANCE OF CHP PROJECTS FOR FUTURE ENERGY MARKETS IN INDIA

Low capital costs, gestation periods, better economical benefits and environmental benignners of CHP projects make them immensely attractive to industries as well as the Governments.

Focus shift of the Government from conventional power to renewable / CHP projects will make these projects better option for industries in the future energy markets in India.

The up-coming incentives from the Government and CDM / JI initiatives will make CHP projects economically for more attractive option for integration.

The anticipated rapid growth of CHP projects in India make them very important.

STATUS & LESSONS LEARNED

A. STATUS

Sr. No.	Sub-sectors	Realisable Potential (MW)	Status (MW) Commissioned as of Dec. 99	Under construction / in pipeline	Total
1	Sugar	3000	175	500	675
2	Dairies, Distilleries & Breweries	2500	50	100	150
3	Rice mills	1100	50	100	150
4	Cotton textile & man-made fiber	800	25	50	75
5	Paper & pulp	750	50	100	150
6	Other sectors (Chemicals, Fertilisers, Petrochemicals / refineries, Metal industries, cement / tyre & plywood mfg., coke oven batteries & commercial sectors)	3350	300	500	800
	Total	**11500**	**650**	**1350**	**2000**

STATUS & LESSONS LEARNED (CONTD.)

B. LESSONS LEARNED

Despite promotional efforts for last 2 decades, the results are well below expectations, primarily due to socio-political-economic complexities and barriers

Slow pace of globalization of Indian economy, cross subsidization & un-realistic pricing of energy have not really compelled energy consumers to cut down their consumption & look for cheaper options like CHP

Social & environmental costs are getting loaded successively on energy prices and the period from the new millenium will compel consumers to cut down costs for survival as well as choose alternate / cheaper options like CHP

Slowly but steadily, the political will (again for own political survival) and convergence of attitude of the stakeholders are seen, if right direction, approach & facilitation are provided by the beurocracy, on either side

Due to paucity of capital, innovative financing instruments & mechanisms are essential for implementing CHP projects

Obvious need for tremendous facilitation is felt

Awareness & skill up-gradation are still inadequate

Technological advancements, research & development will be further required

STAKEHOLDERS & INCENTIVES

Stakeholders

- Ministry of Non-Conventional Energy Sources (MNES)
- State Nodal Agencies
- Financial Institutions, National (IREDA / REC / HUDCO / PFC / ICICI / IDBI / IFCI / NCDC) & International (World Bank / ADB)
- International Institutions like UNDP / USAID / Winrock International / SDC / GEF
- Industry Associations
- Consultants & Experts
- Federations
- State Electricity Boards (SEBs)
- State Energy Departments
- State Co-operative Departments
- Project Developers
- Equipment Suppliers
- Service Providers
- Private & Co-operative Sector Investors
- NGO's

Development Incentives

- Low Custom Duties
- Accelerated Depreciation & Income Tax Holidays
- Exemption to Excise Duty & Sales Tax
- Demonstration Projects
- Interest Subsidy Scheme
- Grant-in-aid for DPR / Assessment Studies
- Attractive Lending Norms
- 13-16 % interest rate
- moratorium 0-3 years
- repayment 8-10 years
- reduction in interest rate for timely repayment
- Almost uniform power purchase policy
- Power buyback rate of Rs. 2.25/KWH or 5.2 cents/KWH, 1994-95 base year
- 5% escalation every year
- 2-7 % wheeling charges
- Banking up to 12 months allowed
- Third party sale allowed
- Fuel pass through up to 40 % of total generation in Maharashtra
- Currency fluctuation risk cover over 5 % variation
- State capital subsidy / grants in some States like Karnataka
- State equity participation in some States like Karnataka
- Evacuation arrangements by SEBs and infrastructure support

BARRIERS

- Inadequate data base generation & dissemination
- Inadequate R & D and HRD initiatives
- Inadequate capacity of the stakeholders
- Inadequate demonstration experience for different options of technologies and project development models, for different / potential industry sectors
- Lack of adequate information on resource availability, techno-economic viability, technology evaluation / validation / bench marking, commercial & financial risks, etc.
- Lack of adequate facilitation for achieving convergence of mindsets of stakeholders, particularly SEB's and State Governments
- Lack of commercial / business and support service networks on sustainable basis

POTENTIAL FOR CHP AS CDM PROJECTS IN INDIA

Sr. No.	Sub-sector	Realisa-ble Potent-ial (MW)	Sector Maturity Rating	Invest-ment (US $ Million / MW)	Carbon Credit Potential ('000 T / Yr. / MW)	Expected Capacity Addition (MW) & Carbon Credit Potential (Million MT / Yr.)		
						Up to 2001	2001 – 2005	2006 - 2010
1	Sugar	3000	A	0.75	6.41	250 (1.60)	750 (4.81)	1000 (6.41)
2	Dairies, Distilleries & Breweries	2500	B	0.70	7.68	100 (0.77)	300 (2.31)	500 (3.85)
3	Rice Mills	1100	A	0.70	7.68	50 (0.38)	200 (1.54)	500 (3.85)
4	Cotton textile & man-made fiber	800	B	0.70	7.68	50 (0.38)	100 (0.77)	200 (1.54)
5	Paper & pulp	750	B	0.70	7.68	50 (0.38)	100 (0.77)	200 (1.54)
6	Other sectors	3350	C	0.70	7.68	100 (0.77)	300 (2.31)	500 (3.85)
	Total	**11500**				**600 (4.28)**	**1750 (12.51)**	**2900 (21.04)**

CASE STUDY

Sugar Mill Co-generation Power Project

1.	Mill capacity	:	5000 Tones of Cane / Day (TCD) or 208 Tones of Cane / Hour (TCH)
2.	Cane crushing	:	9,00,000 MT / season of 180 days
3.	Bagasse generation	:	3,00,000 MT / season
4.	Captive steam requirement	:	105 TPH (50 % on cane)
5.	Captive power requirement	:	6 MW during season, with electric mill drive
6.	Cogen plant installed capacity	:	20 MW (180 days on mill bagasse; 120 days on purchased bagasse / bio-mass / fossil fuel)
7.	Power export	:	12 MW during season, 17 MW during off-season (100 M KWH/year)
8.	Project cost & means of finance	:	Rs. 650 M or US $ 14 M (25 % equity, 75 % term loan @ 13 % with interest subsidy)
9.	Project income	:	Rs. 316 M @ Rs. 3.16 / KWH for 2001-2 AD
10.	DSCR / IRR / payback	:	Average 2.0; 30 % on post tax & equity; 6-7 years
11.	Carbon emission reduction @ 0.3 kg/kwhr	:	30,000 MT / year
12.	Carbon credit/yr. @ US $ 15/MT	:	US M $ 0.45 / year
13.	Major equipment /	:	66 kg/cm2 pressure boilers (2X70 TPH capacity), 1X20 MW DEC TG set, grid paralleling / interfacing equipment, water treatment plant & civil works
14.	Land requirement	:	25 acres of land

ADDITIONALITY, BASELINE & OTHER IMPORTANT ISSUES

The pace of implementation of CHP projects in India is still very low, due to complexities of socio - political - economic issues and barriers, even after the promotional efforts of last 20 years. The situation may still continue over next decade. Any advancement of time span for implementing these projects, through mechanisms like CDM, itself is an additionality, over the baseline of continued low pace of implementation.

For combined heat and power projects for qualifying as CDM projects, sectoral baselines will have to be worked out for conventional or commercialised technology levels, along with clear-cut border line definitions, e.g. sugar mill co-generation projects at 60 kg/cm2 pressure and temperature configuration are slowly getting commercialised in India, yet will require additional 3/4 years for full scale commercialisation. In such situation, whether 60 kg/cm2 project on IPP mode, conceived today, from project developer from say US can qualify as CDM project or not ? Also, the power generation efficiencies will have to consider Indian technology as baseline for such projects. The extra high pressure configuration projects will certainly qualify as CDM.

ADDITIONALITY, BASELINE & OTHER IMPORTANT ISSUES (Contd.)

The Government of India will have to sign the kyoto protocol to make CDM applicable for energy efficiency / CHP projects in India. A joint statement on co-operation in energy and environmental aspects signed on October 26th 1999 between Mr. Bill Richardson, Energy Secretary, USA and Mr. Jaswant Singh, Minister for External Affairs, GoI is crucial and needs to be followed up. Based on this the GoI has already issued guidelines for preparedness for CDM to various concerned Ministries like MNES / MoEF / MoP and MNES becomes the major role player for these projects.

Lot of facilitation at key levels is required to arrive at right kind of overall approach for CDM projects in India and methodology of defining the baselines / additionality. Creation of convergence of attitudes of all the stakeholders is most relevant.

MITCON'S BACKGROUND

- ⇒ Promoted by India's main financial institutions, public commercial banks & Maharashtra State Government Corporations
- ⇒ 18 years of experience in industrial, technical & management consultancy services of diverse range in
  - pre-investment
  - project management
  - project finance
  - macro & policy studies
  - training & human resource development
- ⇒ Focus service sectors
  - energy efficiency
  - environment
  - renewable energy
  - bio-mass & co-generation power
  - industrial infrastructure
  - sustainable building materials
  - rural industrialisation
  - information business
  - agri business
  - entrepreneural training & promotion
  - climate change

MITCON'S BACKGROUND (Contd.)

- ISO 9001 company, professionally managed company, well equipped offices in Pune, Mumbai & New Delhi
- Working relations with all major stakeholders for possible CHP projects in India, in all focus sectors
- Linkages with similar State level Technical Consultancy Organisation in 18 States of India
- Experience of major macro studies & assignments like
  - Situation report on energy, All India Bagasse Cogen Study
  - Application of energy efficiency data protocol for Indian sugar mills project brief for UNDP-MNES-GEF
  - Participation in removal of barriers to bio-mass power generation project of GoM - UNDP - GEF
  - Lead Programme Partner of MNES for development of bagasse co-generation and bio-mass power projects in India
  - Business Development Associate of IREDA
  - Implementation of demo project for environment / energy efficient Vertical Shaft Brick Kiln project for SDC, having huge multiplication potential
  - Project developer interface services
  - Range of pre & post investment services for bio-mass / bagasse power projects
  - Energy audits (completed over 175 assignments)
  - Environment Impact Assessment studies
  - Loan / grant-in-aid syndication services
  - Project management services for implementation of 22 MW sugar mill cogen power project in Karnataka in a record 16 months time and stabilisation within 2 months of commissioning

CDM / JI & EMISSION TRADE BUSINESS PERSPECTIVE, CHP SECTOR IN INDIA

POTENTIAL

Sr. No.	Item	Period			
		Up to 2001 AD	2001 – 2005 AD	2006 – 2010 AD	2001 – 2010 AD Cumulative
1.	Expected Capacity Additions (MW)	600	1750	2900	5250
2.	Carbon Credit Potential (Million MT / Yr.)	4.28	12.51	21.04	37.83
3.	Total Investment Required (US $ M)	292.5	1262.50	2080.00	3635.00
4.	Carbon Credit Business (@ $ 10 / MT), US $ M	42.80	125.10	240.40	378.30

CDM / JI & EMISSION TRADE BUSINESS PERSPECTIVE, CHP SECTOR IN INDIA (Contd.)

BUSINESS OPPORTUNITIES

Equipment & Project Supply

Project Development & ESCO Models

Financing & Leasing

Carbon Credit Syndication

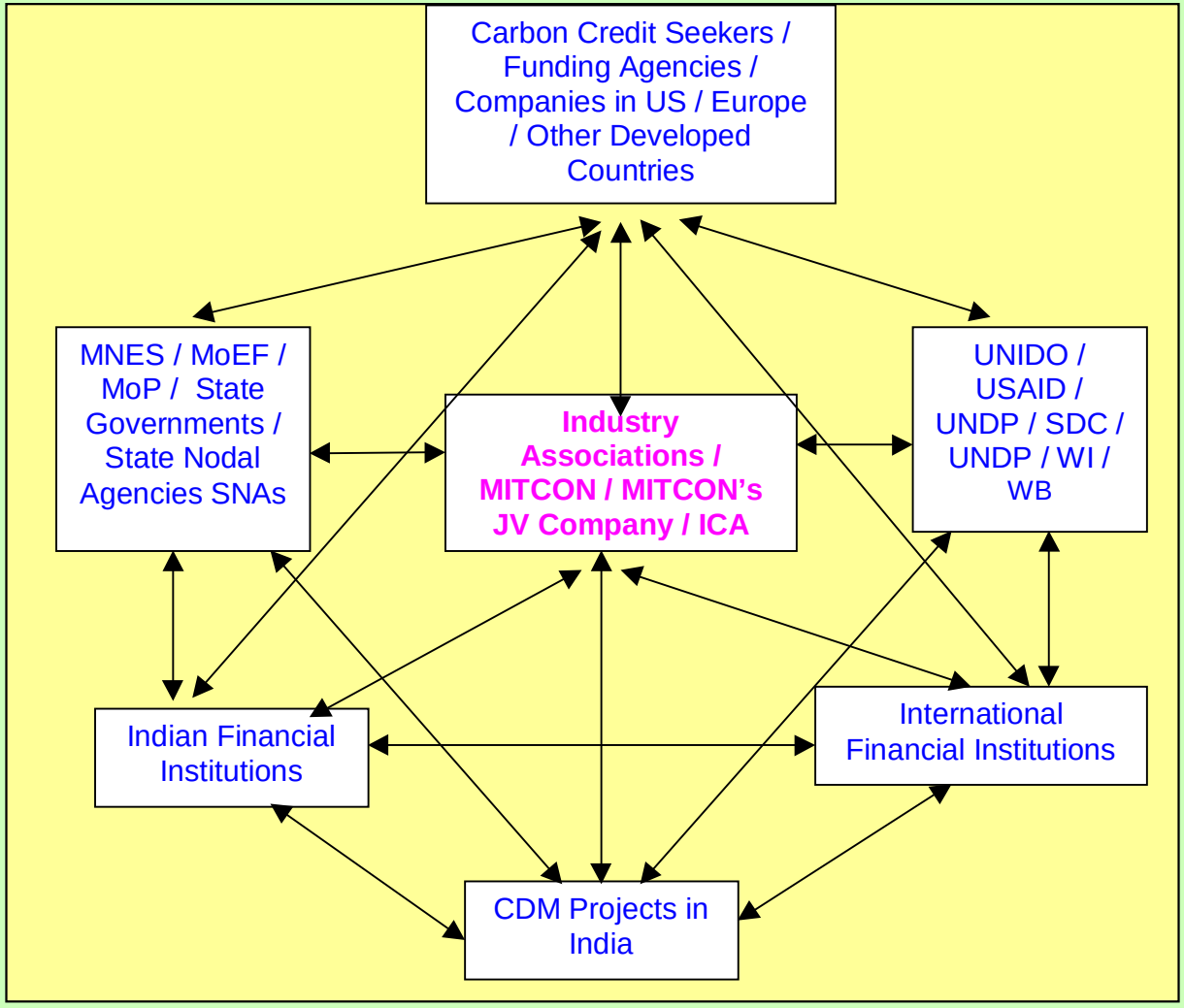
Macro, Policy & Development Initiatives

Consultancy / Advisory Services

Other Services (O & M, etc.)

CDM / JI & EMISSION TRADE BUSINESS PERSPECTIVE, CHP SECTOR IN INDIA (Contd.)

PROPOSED LINKAGES



RECOMMENDED ACTION PLAN

Sr. No.	Action Item	Resposibility	Suggested Time Schedule
1.	International intervention / facilitation with GoI for exact implications / preparedness for the CDM & further signing of Kyoto Protocol	MNES / MoEF / MoP / PMO / UNIDO / UNDP / CII / FICCI	Jun. 2001
2.	Identification of concerned Ministries, stakeholders & potential facilitation agencies for industrial energy efficiency & CHP sectors in India	MNES / MoP / CII / FICCI / MITCON	Mar. 2000
3.	Assessment & validation of total / realisable potential, sector and sub-sector specific	MNES / MoP / CII / FICCI / MITCON	Sept. 2000
4.	Identification of projects in CHP sectors meeting national / MNES priorities, potential for finance and technology in flows, etc.	MNES / MoP / CII / FICCI / MITCON	Sept. 2000
4.	Analysis & validation of barriers & preparation of barrier removal plan	MNES / MoP / CII / FICCI / MITCON	Dec. 2000
5.	Organisation of stakeholder's workshops, sector / sub-sector specific, & prepare promotion / development plan	MNES / MoP / CII / FICCI / MITCON	Sept. 2000
6.	Preparation of CDM simulation case studies, sector / sub-sector specific, determination of funding additionality, formulation of baselines for qualifying emission reduction, standardisation of CDM project cycles, etc.	MNES / MoP / CII / FICCI / MITCON / International agencies	Dec. 2000
7.	Develop the future institutional linkages	MNES / MoP / CII / FICCI / MITCON / International agencies	Mar. 2001
8.	Develop, review / monitoring mechanism & schedule	MNES / MoP / CII / FICCI / MITCON / International agencies	Sept. 2001